TITLE OF THE INVENTION

IMAGE PICKUP APPARATUS HAVING
FLASH AND COLOR ADJUSTMENT CONTROL

5

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an image pickup

10 apparatus capable of using a flash apparatus.

Description of the Related Art

In an image pickup apparatus such as an electronic

camera, it is required to use a flash apparatus (flash)

when a picture of a subject is taken in a low ambient light

15 environment or in a backlighted situation.

It is also required to adjust the white balance in

accordance with the color temperature of a subject. However,

in the case where artificial lighting is employed, color

rendering is poor and thus correction of only the white

20 balance is not sufficient to obtain good color balance in

many cases. In view of the above, various techniques have

been proposed for correcting a hue or chroma saturation

depending on the white balance. Some of those conventional

techniques are described below with reference to the

25 drawings.

Fig. 6 is a block diagram illustrating an image
sensing system used in a conventional electronic camera. As
shown, the image sensing system include a lens 201, an iris
diaphragm 202, an image sensing device 203, a luminance
5   signal generating circuit 204 for generating a luminance
signal in accordance with the output of the image sensing
device, a luminance signal processing circuit 205 for
performing processing such as gamma processing and edge
enhancement, a color separation circuit 206 for generating
10 color signals associated with three colors R, G, and B, a
white balance amplifier 207 for controlling the white
balance by adjusting the gains associated with the R-signal
and B-signal, a color difference matrix circuit 208 for
generating color difference signals R-Y and B-Y from the R-,
15 G- and B-signals output from the white balance amplifier
207, a linear matrix circuit 209 for adjusting the hue, a
color difference gain control circuit 210 for adjusting the
color saturation by controlling the gains of the color
difference signals R-Y and B-Y, an encoder 211 for
20 generating a video signal from the luminance signal and the
color difference signals, a white balance control circuit
212 for extracting color temperature information from the
color difference signals and controlling the gain of the
white balance amplifier 207, a hue correcting circuit 213
25 for correcting the hue and the chroma saturation based on

the white balance information supplied from the white
balance control circuit 212, a flash apparatus 214, and a
flash control circuit 215 for controlling the timing and
the amount of light generated by the flash apparatus 214.

5   Light incident on the lens 201 is passed through the
iris diaphragm 202 and adjusted as to control the amount of
exposure. The light then falls on the image sensing device
203. The image sensing device 203 converts the received
light to a corresponding electric charge and accumulates it.
10   The image signal output from the image sensing device 203
is separated by the luminance signal generating circuit 204
into a luminance signal Y and a color signal. The resultant
luminance signal Y is applied to the luminance signal
processing circuit 205 and subjected to processing such as
15   gamma processing and edge enhancement.

On the other hand the color signal is applied to the
color separation circuit 206 and separated into three color
signals R, G, and B. The white balance amplifier 207 makes
a white balance adjustment on the R-, G-, and B-signals and
20   also performs gamma processing on them. The resultant R-,
G-, and B-signals are applied to the color difference
matrix circuit 208 and converted into color difference
signals R-Y and B-Y. The resultant color difference signals
R-Y and B-Y are applied to the linear matrix circuit 209
25   and adjusted in terms of the hue.

The signals output from the linear matrix circuit 209 are applied to the color difference gain control circuit 210 and the gains of the respective color difference signals R-Y and B-Y are adjusted. The resultant signals output from the color difference gain control circuit 210 are applied to the encoder 211 and encoded into a video signal. The signals output from the color difference gain control circuit 210 are also supplied to the white balance control circuit 212. The white balance control circuit 212 detects the color temperature from the color difference signals. The white balance control circuit 212 then calculates the gain of the white balance amplifier 207 in accordance with the detected color temperature and controls the white balance.

The flash control circuit 215 controls the flash apparatus 214 such that light is generated by the flash apparatus 214 during a charge accumulation period of the image sensing device 203, wherein the amount of light is controlled in accordance with the luminance signal Y.

The color temperature of a subject varies depending on the type of a light source. When artificial lighting is employed, color rendering is poor and thus correction of only the white balance is not sufficient to obtain good color balance in many cases. Therefore it is required to correct also the hue and the chroma saturation depending on

the white balance.

Thus, the white balance control circuit 212 supplies white balance correction information to the hue correcting circuit 213. The hue correcting circuit 213 calculates an optimum hue from the white balance information and controls the linear matrix circuit 209 and the color difference gain control circuit 210 so as to obtain the optimum hue. Herein, the output signals of the linear matrix circuit 209 are given by:

$$(R - Y)' = (R - Y) + \alpha(B - Y) \quad (-1 < \alpha < 1) \qquad (1)$$

$$(B - Y)' = (B - Y) + \beta(R - Y) \quad (-1 < \beta < 1) \qquad (2)$$

Thus, it is possible to adjust the hue of the color difference signals by varying factors α and β, in equations (1) and (2), of the linear matrix circuit 209. That is, the hue correcting circuit 213 corrects the hue by adjusting α and β associated with the linear matrix circuit 209.

In the case where the flash apparatus 214 is used, it is required to correct the white balance depending on the intensity of ambient light and the amount of light generated by the flash apparatus 214. The flash control circuit 215 supplies information representing the intensity of ambient light determined from the luminance signal Y and also representing the amount of light generated by the flash apparatus 215 to the white balance control circuit 212. In accordance with the received information, the white

balance control circuit 212 controls the white balance for an image taken using the flash apparatus 214.

In the above-described conventional image pickup apparatus, although the white balance can be corrected for 5 an image taken using the flash apparatus, the hue or chroma saturation is not adjusted in accordance with the color rendering of the flash.

Figs. 5A and 5B illustrate spectral distributions of solar light and flash light, respectively. As can be seen 10 from Figs. 5A and 5B, the color rendering of the flash is lower than that of the solar light. This causes not only a difference in color temperature but also a difference in color balance.

This means that when a picture is taken using a flash 15 apparatus under conditions in terms of hues optimized for solar light, it is not always possible to achieve good color balance.

SUMMARY OF THE INVENTION

20 Thus, an object of the present invention is to provide an image pickup apparatus capable of achieving optimum color balance when a picture is taken using a flash apparatus.

According to an aspect of the present invention, to 25 achieve the above object, there is provided an image pickup

apparatus using a flash apparatus (flash apparatus 114 in embodiments described later), comprising: amount-of-light controlling means (flash control circuit 115 in the embodiments described later) for controlling the amount of

5   light generated by the flash apparatus; color adjusting means (linear matrix circuit 109 and/or gain control circuit 110 in the embodiments described later) for controlling a hue or color saturation; and first hue controlling means (color correcting circuit B 116 in the

10 embodiments described later) for controlling the color adjusting means such that the hue or color saturation is corrected in accordance with the amount of light determined by the amount-of-light controlling means.

Preferably, the above-described image pickup

15 apparatus further comprises color temperature detecting means (white balance control circuit 112 in the embodiments described later) for detecting the color temperature of a subject; and second hue controlling means (color correcting circuit A 113 in the embodiments described later) for

20 controlling the color adjusting means in accordance with the color temperature of the subject, wherein the first hue controlling means corrects the correction result of the second hue controlling means.

In the above-described image pickup apparatus

25 according to the present invention, the color adjusting

means may include a matrix circuit (linear matrix circuit 109 in the embodiments described later) which multiplies a first color difference signal (R-Y in the embodiments described later) by a factor and adds the result to a

5 second color difference signal (B-Y in the embodiments described later) and which multiplies the second difference signal by a factor and adds the result to the first color difference signal.

According to another aspect of the present invention,

10 there is provided an image pickup apparatus using a flash apparatus (flash apparatus 114 in the embodiments described later), comprising: illuminance detecting means (luminance signal generating circuit 104 in the embodiments described later) for detecting the illuminance of a subject; color

15 adjusting means (linear matrix circuit 109 and/or gain control circuit 110 in the embodiments described later) for controlling a hue or color saturation; and first hue controlling means (color correcting circuit B 116 in the embodiments described later) for controlling the color

20 adjusting means such that the hue or color saturation is corrected in accordance with the illuminance detected by the illuminance detecting means.

Preferably, the above-described image pickup apparatus further comprises color temperature detecting

25 means (white balance control circuit 112 in the embodiments

described later) for detecting the color temperature of a subject; and second hue controlling means (color correcting circuit A 113 in the embodiments described later) for controlling the color adjusting means in accordance with

5 the color temperature of the subject, wherein the first hue controlling means makes a correction on a value corrected by the second hue controlling means.

In the above-described image pickup apparatus according to the present invention, the color adjusting

10 means may include a matrix circuit (linear matrix circuit 109 in the embodiments described later) which multiplies a first color difference signal (R-Y in the embodiments described later) by a factor and adds the result to a second color difference signal (B-Y in the embodiments

15 described later) and which multiplies the second difference signal by a factor and adds the result to the first color difference signal.

According to still another aspect of the present invention, there is provided an image pickup apparatus

20 using a flash apparatus (flash apparatus 114 in the embodiments described later), comprising: color temperature detecting means (white balance control circuit 112 in the embodiments described later) for detecting the color temperature of a subject; illuminance detecting means

25 (luminance signal generating circuit 104 in the embodiments

described later) for detecting the illuminance of a subject; amount-of-light controlling means (flash control circuit 115 in the embodiments described later) for controlling the amount of light generated by the flash

5   apparatus; color adjusting means (linear matrix circuit 109 and/or gain control circuit 110 in the embodiments described later) for controlling hue or color saturation; first hue controlling means (color correcting circuit A 113 in the embodiments described later) for controlling a hue

10   or color saturation in accordance with the color temperature of a subject detected by the color temperature detecting means; and second hue controlling means (color correcting circuit B 116 in the embodiments described later) for controlling the color adjusting means such that

15   the hue or color saturation is corrected in accordance with the illuminance detected by the illuminance detecting means and also in accordance with the amount of light determined by the amount-of-light controlling means.

In the above-described image pickup apparatus

20   according to the present invention, the color adjusting means may include a matrix circuit (linear matrix circuit 109 in the embodiments described later) which multiplies a first color difference signal (R-Y in the embodiments described later) by a factor and adds the result to a

25   second color difference signal (B-Y in the embodiments

described later) and which multiplies the second difference signal by a factor and adds the result to the first color difference signal.

According to still another aspect of the present

5   invention, there is provided an image pickup apparatus capable of using a flash apparatus (flash apparatus 114 in the embodiments described later), comprising: color adjusting means (linear matrix circuit 109 and/or gain control circuit 110 in the embodiments described later) for

10 controlling hue or color saturation; color temperature detecting means (white balance control circuit 112 in the embodiments described later) for detecting the color temperature of a subject; first hue controlling means (color correcting circuit A 113 in the embodiments

15 described later) for controlling the color adjusting means in accordance with the color temperature of a subject detected by the color temperature detecting means; memory means (memory 117 in the embodiments described later) for storing hue information used to make a color correction

20 when the flash apparatus is used; and second hue controlling means (color correcting circuit B 116 in the embodiments described later) for controlling the color adjusting means in accordance with the hue information stored in the memory means such that the hue information

25 for the flash apparatus is selected when the flash

apparatus is used.

In the above-described image pickup apparatus according to the present invention, the color adjusting means may include a matrix circuit (linear matrix circuit

5 109 in the embodiments described later) which multiplies a first color difference signal (R-Y in the embodiments described later) by a factor and adds the result to a second color difference signal (B-Y in the embodiments described later) and which multiplies the second difference

10 signal by a factor and adds the result to the first color difference signal.

According to still another aspect of the present invention, there is provided an image pickup apparatus using a flash apparatus (flash apparatus 114 in the

15 embodiments described later), comprising: white balance controlling means (white balance control circuit 112 in the embodiments described later) for controlling white balance in accordance with the illuminance of a subject or the amount of light generated by the flash apparatus; color

20 adjusting means (linear matrix circuit 109 and/or gain control circuit 110 in the embodiments described later) for controlling hue or color saturation; and hue controlling means (color correcting circuit A 113 and color correcting circuit B 116 in the embodiments described later) and for

25 controlling the color adjusting means in accordance with

the white balance information generated by the white
balance controlling means such that when white balance
information varies in response to the illuminance of the
subject or the amount of light generated by the flash

5   apparatus, the hue controlling means controls the color
adjusting means in accordance with the white balance
information.

In the above-described image pickup apparatus
according to the present invention, the color adjusting

10   means may include a matrix circuit (linear matrix circuit
109 in the embodiments described later) which multiplies a
first color difference signal by a factor and adds the
result to a second color difference signal and which
multiplies the second difference signal by a factor and

15   adds the result to the first color difference signal.

According to still another aspect of the present
invention, there is provided an image pickup apparatus
using a flash apparatus (flash apparatus 114 in the
embodiments described later), comprising: color adjusting

20   means (linear matrix circuit 109 and/or gain control
circuit 110 in the embodiments described later) for
controlling hue or color saturation; and hue controlling
means (color correcting circuit 317 in the embodiments
described later) for controlling the color adjusting means

25   such that when the flash apparatus is used, the color

adjusting means corrects the hue or color saturation.

In the above-described image pickup apparatus according to the present invention, the hue correcting means (color correcting circuit 317 in the embodiments

5 described later) may have correction data (hue data B) associated with the hue or color saturation employed when the flash apparatus is used and also have correction data (hue data B) associated with the hue or color saturation employed when the flash apparatus is not used, and wherein

10 the hue correcting means selects proper correction data depending on whether the flash apparatus is used or not.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram illustrating a first

15 embodiment of the present invention;

Figs. 2A to 2C are vector diagrams illustrating color balance for various types of light sources;

Fig. 3, which includes Figs. 3A to 3D, is a conceptual representation of a color balance correction

20 operation according to the first embodiment of the present invention;

Fig. 4 is a block diagram illustrating a second embodiment of the present invention;

Figs. 5A and 5B are graphs illustrating a spectral

25 distribution of ambient light and light generated by a

flash apparatus, respectively; and

Fig. 6 is a block diagram illustrating a conventional technique.

5 ## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is described in further detail below with reference to preferred embodiments in conjunction with the accompanying drawings.

10 ### First Embodiment

Fig. 1 is a block diagram illustrating an image pickup apparatus embodying the present invention, in which good color balance can be achieved when a picture is taken using a flash apparatus.

15 As shown in Fig. 1, the image pickup apparatus includes an imaging lens 101, an iris diaphragm 102, an image sensing device 103, a luminance signal generating circuit 104 for generating a luminance signal in accordance with the output of the image sensing device 103, a

20 luminance signal processing circuit 105 for performing processing such as gamma processing and edge enhancement, a color separation circuit 106 for generating color signals associated with three colors R, G, and B, a white balance amplifier 107 for controlling the white balance by

25 adjusting the gains associated with the R-signal and B-

signal, a color difference matrix circuit 108 for generating color difference signals R-Y and B-Y from the R-, G- and B-signals output from the white balance amplifier 107, a linear matrix circuit 109 which receives the color

5   difference signals R-Y and B-Y from the color difference matrix circuit 108 and which makes an adjustment thereon, a color difference gain control circuit 110 for adjusting the color saturation by controlling the gains of the color difference signals R-Y and B-Y, an encoder 111 for

10 generating a video signal from the luminance signal and the color difference signals, a white balance control circuit 112 for extracting color temperature information from the color difference signals and controlling the gain of the white balance amplifier 107, a hue correcting circuit A 113

15 for correcting the hue and the chroma saturation based on the white balance information supplied from the white balance control circuit 112, a flash apparatus 114, a flash control circuit 115 for controlling the timing and the amount of light generated by the flash apparatus 114, and a

20 hue correcting circuit B 116 for correcting the hue and the chroma saturation based on the information representing the amount of light generated by the flash apparatus supplied from the flash control circuit 115.

The flow of signals among blocks 101-115 and the

25 operations of these blocks are similar to those for blocks

201-215 shown in Fig. 6.

The flash control circuit 115 supplies information about the illuminance of a subject obtained from the luminance signal and information about the amount of light
5   generated by the flash apparatus 114 to the white balance control circuit 112 and the color correcting circuit B 116.

When the flash apparatus 114 is used, the white balance control circuit 112 controls the white balance based on the illuminance of the subject and the amount of
10 light generated by the flash apparatus 114 as in the conventional image pickup apparatus described earlier.

The color correcting circuit B 116 is an essential part that characterizes the present embodiment. That is, the color correcting circuit B 116 corrects the color
15 balance of an image taken using the flash apparatus 114, in accordance with the subject's illuminance determined from the signal level of the luminance signal Y supplied via the flash control circuit 115 and also in accordance with the amount of light generated by the flash apparatus 114
20 wherein the correction of the color balance is performed by controlling the linear matrix circuit 109 and the color difference gain control circuit 110.

Figs. 2A to 2C are vector diagrams in the color difference coordinates R-Y and B-Y, illustrating a shift in
25 color balance which occurs when an image is taken under

illumination from an incandescent lamp and a shift which

occurs when the image is taken under illumination from a

fluorescent tube, where Fig. 2A is a vector diagram of a

color bar chart photographed under illumination of an ideal

5   light source, Fig. 2B is a vector diagram of a color bar

chart photographed under illumination from an incandescent

lamp, and Fig. 2C is a vector diagram of a color bar chart

photographed under illumination from a fluorescent tube.

In these figures, open rectangles denote vectors in

10   color difference coordinates for each color of the color

bar charts photographed, and shaded circles or ellipses

denote vectors for color signals detected.

Fig. 2A illustrates color difference vectors obtained

when the color bar chart is photographed under ideal

15   illumination. In this case, original colors are reproduced

faithfully.

In the case of Fig. 2B, in which illumination is

provided by an incandescent lamp, expansion in R and

contraction in Ye occur with respect to the color

20   difference vectors obtained under ideal illumination.

On the other hand, under illumination provided by a

fluorescent tube, as shown in Fig. 2C, contraction in R and

expansion in Ye occur with respect to the color difference

vector obtained under ideal illumination. These shifts in

25   the color balance are corrected by the hue correcting

circuit 213 in the conventional image pickup apparatus while the shifts are corrected by the hue correcting circuit A113 in the present embodiment of the present invention.

5   Fig. 3, including Figs. 3A to 3D, illustrates a process of correcting the shift in the color balance which occurs when an incandescent lamp is used. Fig. 3A shows a vector diagram of color balance obtained when the white balance is adjusted under illumination of the incandescent
10   lamp without making any color balance correction. Fig. 3B shows a vector diagram obtained by further making a color balance correction. In this case, the correction is made by compressing R-Y and expanding B-Y. In addition, a linear matrix correction is also made.

15   Fig. 3C shows a vector diagram obtained when a picture is taken using the light of a flash apparatus under the conditions determined in Fig. 3B.

Because the light of a flash apparatus has a spectrum closer to that which results in ideal color balance than an
20   incandescent lamp, the correction of the color balance in accordance with the conditions determined under illumination from an incandescent lamp as shown in Fig. 3B results in a shift from the ideal color balance.

The color balance varies depending on the intensity
25   of the ambient light and the intensity of the light from

the flash apparatus. More specifically, when the intensity of the light from the flash apparatus is weak, the color balance becomes similar to that obtained under illumination from an incandescent lamp, while the color balance becomes

5 similar to that obtained under illumination from a flash apparatus when the intensity of the light of the flash apparatus is high.

Fig. 3D shows a color balance obtained by making a further correction on the conditions shown in Fig. 3C. By

10 multiplying the intensity of the ambient light in the conditions shown in Fig. 3C by a correction factor calculated from the amount of light from the flash apparatus, it is possible to achieve optimum balance for various subjects and for various amounts of light from the

15 flash apparatus.

That is, depending the ratio of the amount of light from the flash apparatus to the intensity of the ambient light, the ratio of the correction associated with an incandescent lamp and the correction associated with the

20 light from the flash apparatus is precisely calculated so as to obtain an optimum color balance.

Thus, the correction value associated with the color balance for the case where an incandescent lamp is used is determined in accordance with the intensity of the ambient

25 light and the amount of light from the flash apparatus

thereby correcting the color balance shown in Fig. 3A so as to obtain the color balance shown in Fig. 3B, and the correction value for the case where the flash apparatus is used is determined in accordance with the intensity of the

5 ambient light and the amount of light from the flash apparatus and also in accordance with the ratio of the intensity of light from the flash apparatus to the intensity of the ambient light, thereby correcting the color balance shown in Fig. 3C so as to obtain the color

10 balance shown in Fig. 3D. Thus, optimum color balance can be obtained for both cases.

Although in the above description, the correcting process is performed sequentially starting from the step shown in Fig. 3A to the step shown in Fig. 3D, it is

15 possible to directly obtain conditions shown in Fig. 3D in accordance with the intensity of the ambient light and the calculated amount of light from the flash apparatus.

As can be seen from the above description, when an image is taken using the flash apparatus, it is possible to

20 achieve an optimum color balance for any condition associated with the flash by correcting the color balance in accordance with the intensity of the ambient light and the amount of light generated by the flash apparatus.

Although in the present embodiment described above,

25 the color balance is corrected based on both the intensity

of the ambient light and the amount of light from the flash apparatus, it may be possible to correct the color balance based on either one of the intensity of the ambient light and the intensity of the light from the flash apparatus.

5   That is, when an image is taken, whether the flash apparatus should be used or not may be determined in accordance with the intensity of the ambient light, and the intensity of light to be generated by the flash apparatus may be calculated in accordance with the intensity of the

10   ambient light, and thus the color balance may be properly controlled in accordance with the intensity of the ambient light. Alternatively, the color balance may be controlled in accordance with the amount of light actually generated by the flash apparatus.

15   The correction values of the color balance may be stored in the memory 117, as represented by a broken line in Fig. 1, in the form of a table of data determined as a function of the amount of light generated by the flash apparatus. The correction value may also be calculated by

20   means of linear interpolation.

         The correction as to white balance is not essential to the present invention. That is, the correction described above may be possible based only on correction values determined for the light generated by the flash apparatus.

25   Furthermore, although the color balance is corrected using

a linear matrix circuit in the present embodiment, another
hue adjustment means may be employed.

Second Embodiment

5   Fig. 4 is a block diagram illustrating a second
embodiment of an image pickup apparatus according to the
present invention, in which when a picture is taken using a
flash apparatus, the color balance is simply corrected in
accordance with correction data prepared for use with the
10   flash apparatus.

       Elements 301-311 shown in Fig. 4 correspond to
elements 101-111, respectively, shown in Fig. 1 and
elements 314 and 315 shown in Fig. 4 correspond to elements
114 and 115, respectively, shown in Fig. 1. Reference
15   numeral 317 denotes a hue correcting circuit for
controlling a hue correcting process in accordance with hue
data. Reference numeral 318 denotes a source of hue data A
(e.g., a portion of memory) employed when the flash
apparatus is not used and reference numeral 319 denotes a
20   source of hue data B (e.g., a portion of memory) employed
when the flash is used. Reference numeral 320 denotes a
switch for switching between the source of hue data A 318
and the source of hue data B 319.

       In Fig. 4, the video signal flows in a similar manner
25   to the first embodiment. The flash control circuit 315

controls the switch 320 such that the switch 320 selects hue data B 318 when the flash apparatus is not used, while the switch 320 selects hue data A 319 when the flash apparatus is used.

5   Color rendering obtained when the flash apparatus is used is described below. Figs. 5A and 5B illustrate spectral distributions of solar light and light from a flash apparatus, respectively. Fig. 5A illustrates a spectral distribution of solar light on which the color

10   rendering is based. That is, hues are generally determined such that a color bar chart photographed under illumination of solar light has optimum color balance. The hue data A 318 represents such hues. Fig. 5B illustrates a spectral distribution of light generated by the flash apparatus. As

15   can be seen, the flash provides relatively high color rendering although not as high as 100%.

The hue data B 319 represents hues which give optimum color balance when the color bar chart is photographed using the flash apparatus.

20   By employing the color balance data prepared for use in photographing with the flash apparatus, as described above, it becomes possible to achieve optimum color balance when a picture is taken using the flash apparatus.

In the present embodiment, when a picture is taken

25   without using the flash apparatus, the hue data optimized

for solar light is employed. However, hue data optimized for another light source other than solar light may also be employed. A plurality of hue data may be prepared so that proper hue data may be selected depending on a factor other than the flash. Furthermore, although the color balance correction is performed using a linear matrix circuit in the present embodiment, another hue adjustment means may be employed.

As described above, the present invention provides a technique for achieving optimum color balance when a picture is taken using a flash apparatus by switching the settings associated with the hue or color saturation in accordance with either one or both of the amount of light generated by the flash apparatus and the intensity of ambient light.

The present invention also provides a technique for achieving optimum color balance when a picture is taken using the flash apparatus by switching the settings associated with the hue or color saturation in accordance with white balance information so as to adjust the white balance depending on the amount of light generated by the flash apparatus and the intensity of the ambient light.

While the present invention has been described with respect to what is presently considered to be the preferred embodiments, it is to be understood that the invention is

not limited to the disclosed embodiments. To the contrary,
the invention is intended to cover various modifications
and equivalent arrangements included within the spirit and
scope of the appended claims. The scope of the following
5   claims is to be accorded the broadest interpretation so as
to encompass all such modifications and equivalent
structures and functions.